Factors Affecting the Delivery and Trends of Nutrients and Sediment to the Chesapeake Bay

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Collaborators: Chesapeake Bay Program (over 25 Federal Agencies, 6 States, the District of Columbia, and numerous local customers and partners) and Maryland Department of Natural Resources

Statement of Problem: The Chesapeake Bay Program (CBP) is attempting to improve water quality to support living resources in the Bay. In 1987, efforts were begun to reduce nutrient loadings to improve dissolved oxygen levels. In 2000, the Chesapeake Bay was listed as an impaired water body under the Clean Water Act and the CBP is developing standards for dissolved oxygen, chlorophyll, and water clarity. The standards must be met by 2010. Enhanced predictive models are needed to simulate the relation between nutrient sources and occurrence, monitoring must be expanded to document and evaluate environmental response to the nutrient-reduction strategies, and studies to understand the processes affecting nutrient delivery to the Bay must be conducted.

Objectives: As part of the project, a nontidal database is (1) updated and maintained by USGS from which (2) loads and trends at selected sites are estimated on an annual basis.

Approach: The USGS is addressing the water-quality issues through joint development of a refined watershed model (Phase 5) with the CBP, monitoring of the rivers in the watershed, relating nutrient sources to trends, documenting the influence of ground water on nitrogen movement, and studies of nutrient cycling. The USGS is merging efforts to develop a model for the Potomac watershed with development of the Phase 5 CBP watershed model. USGS will conduct joint development and calibration of the hydrology and nutrient and sediment components of the models during 2002-2003. Additionally, USGS results from ground-water base flow and residence time studies will be used to improve the simulation of hydrology and nutrient movement in the model. Development of the nutrient-reduction strategies in 2002- 03 will be based on the current version of the CBP watershed model, results from the USGS SPARROW models, and monitoring data. The Phase 5 CBP watershed model will be used to assess progress and revise strategies in 2005-06. The USGS is continuing monitoring at the River-Input sites and working with the CBP to develop and implement a nontidal water-quality network for the Bay watershed to support technical needs of the model, and evaluate water-quality improvement in response to the nutrient-reduction strategies. In addition, studies of nutrient enrichment and the effect on stream ecology (Nutrient Enrichment Effect Team (NEET) under the NAWQA Program) will be conducted in the Coastal Plain and sampling to document the effect of land use on ground-water quality will be carried out in areas of the Potomac River Basin and the Eastern Shore. The USGS NAWQA Program has established several long-term collection sites to document the occurrence of pesticides, trace elements, nutrients, and sediment in surface water. These sites include three in the Potomac Basin (Potomac River at Washington, D.C., Accotink Creek, and Muddy Creek), the Susquehanna River at Conowingo, and one site on the Eastern Shore (Morgan Creek). The USGS will also be addressing the occurrence of toxic constituents in ground water that are associated with different types of land use and geology in the Potomac Basin and on the Eastern Shore.

Selected Reports and Other Products:

Report, Planned: M.L. Langland, J.P. Raffensperger, S.W. Phillips, and D.L. Moyer, 2004, Revised Trend Calculation Procedures for the River Input Monitoring Program, USGS, Scientific Investigations Reports

Report, Planned: Langland, Raffensperger, Phillips, and Moyer, 2005, Factors Affecting Nutrient Trends in Major Rivers of the Chesapeake Bay Watershed Update, 1998-2003, USGS, Scientific Investigations Reports

Relevance and Benefits: The overall objective of the USGS Chesapeake Bay Science Program is to provide resource managers with the critical scientific information necessary to understand the complex relation between natural anthropogenic controls on water quality, vital habitats, and living resources in the Bay and its watershed. This project meets the needs of Bay science goals through a combination of monitoring and load and trend estimation. This will subsequently result in the improvement of predictive tools planning restoration strategies and help evaluate ecosystem improvement by 2010.